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Demonstration Bulletin

AOSTRA-SoilTech Anaerobic Thermal Processor: Wide Beach Development Site

SoilTech ATP Systems, Inc.

Technology Description: The anaerobic thermal processor (ATP) was developed by UMATAC Industrial Processes under the sponsorship of the Alberta Oil Sands Technology and Research Authority (AOSTRA) and is licensed by SoilTech ATP Systems, Inc., a U.S. corporation. The ATP technology involves a physical separation process that thermally desorbs organics such as polychlorinated biphenyls (PCBs) from soil and sludge. The ATP process was used in conjunction with optional dehalogenation reagents to chemically treat over 42,000 tons of PCB-contaminated soils at the Wide Beach Development site in Brant, New York. For this demonstration, the contaminated soils are sprayed with a diesel fuel and oil mixture containing alkaline polyethylene glycol (APEG) reagents before entering the preheat zone. The oil mixture acts as a carrier for the dehalogenation reagents.

In the preheat zone (400-650° F), water and volatile organic compounds (VOC) vaporize (Figure 1). At the same time, the reagents dehalogenate or chemically break down chlorinated compounds (including PCBs). The vaporized contaminants and water are removed via a vacuum to a preheat vapor cooling system consisting of a cyclone, condenser, and 3-phase preheat separator. The noncondensed light organic vapors are then fed by a blower directly into the combustion chamber of the processor. The oil fraction is recycled to a reagent blending tank, and recovered water is sent to the onsite treatment system.

From the preheat zone, the hot, granular solids pass through a sand seal to the retort zone (900-1,150° F). Here heavy oils vaporize, and thermal cracking of hydrocarbons forms coke and low molecular weight gases. The vapor stream from the retort zone is removed via a vacuum and passes first through a two-stage pair of cyclones to remove entrained particles. The vapor is then cooled by oil circulating in two packed columns, acting as a two-stage direct contact condenser for the higher boiling point compounds. The uncondensed vapors are then cooled in a water-cooled noncontact condenser and pass through a 3-phase

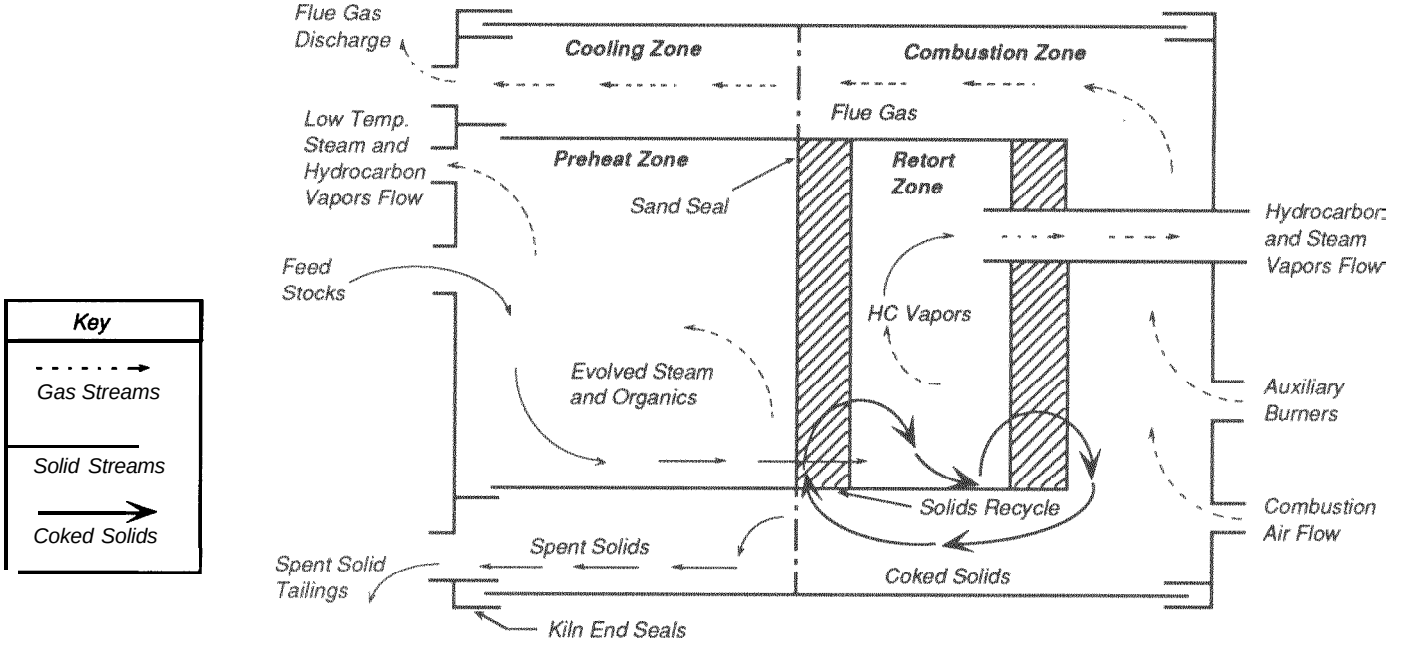

Figure 1. Simplified sectional diagram showing the four internal zones.

separator. The final noncondensable gases are returned to the combustion chamber of the process. The oil phase is combined with the condensate from the packed columns. This oil condensate is then sent to the reagent blending unit to mix with the APEG reagents. The blend is pumped at a measured rate and is applied to the untreated soils in the feed chute of the processor. Condensed water is pumped directly to the onsite treatment system.

The coked soils pass through a second sand seal into the combustion zone (1,200-1,450° F). Here the coked soils are combusted and either recycled to the retort zone or sent to be cooled in the cooling zone. Flue gas from the combustion zone is treated in a system consisting of a cyclone and baghouse that remove particulates; a scrubber that removes acid gases; and a carbon adsorption bed that removes trace organics. The treated flue gas is then discharged to the atmosphere through a stack. Treated soils exiting the cooling zone (500-800° F) are quenched with water and are then transported by conveyor to an outside storage pile.

Waste Applicability: SoilTech reports the following specifications of the ATP system. The optimal moisture content of the waste to be treated is between 5 and 10 weight percent. Wastes with a moisture content up to 20 percent can be treated, but will impact the net throughput rates. Wastes with a moisture content greater than 20 percent may need to be dewatered to optimize process economics. The ATP system is also designed to treat wastes with a nominal hydrocarbon concentration of 10 percent. Heavy oil contaminants have been reduced from as high as 60 percent in the feed to near detection limits in the treated solids.

The rate of contaminant desorption and dechlorination from soils and sediment is influenced by the contaminant concentration. Soil Tech reports that the contaminant concentration in the treated solids is generally independent of the contaminant concentration in the feed waste and will be near the detection limit for the contaminant. The processor treats wastes containing contaminants with low boiling points more effectively than wastes containing contaminants with high boiling points. However, high boiling point organics such as PCBs and polycyclic aromatic hydrocarbons can be removed to concentrations below detection limits of 1 part per million (ppm).

Demonstration Results: The ATP technology was demonstrated at the Wide Beach Development Superfund site in Brant, New York, in May 1991. Three test runs were conducted during the SITE demonstration, each 5½ hours. The solid and liquid locations that were sampled during each run were contaminated feed soil, treated soil, combined flue gas cyclone fines and baghouse dust, preheat vapor cyclone fines, scrubber liquor, condensed water before and after treatment, vapor scrubber oil, and preheat oil. The noncondensed preheat and retort off-gases were also sampled during each run.

Laboratory analyses included analyses of the solids and liquids for PCBs, dioxins/furans, VOCs, and semivolatile organics (SVOCs) to determine the PCB removal efficiency of the processor, the potential degradation products of the PCBs, and the potential formation of dioxins and furans. Total chlorides and total organic halogens (TOX) were also analyzed in an attempt to trace the fate of chlorine throughout the system. In addition, a variety of other parameters were analyzed to characterize the feed and treated soils.

Key findings from the Wide Beach site demonstration are summarized below:

- The SoilTech ATP unit removed PCBs in the contaminated soil to levels below the desired cleanup concentration of 2 ppm. PCB concentrations were reduced from an average concentration of 28.2 ppm in the contaminated feed soil to an average concentration of 0.043 ppm in the treated soil.
- The SoilTech ATP does not appear to create dioxins and/or furans.
- No volatile or semivolatile organic degradation products were detected in the treated soil. There were also no leachable VOCs or SVOCs detected in the treated soil.
- No operational problems affecting the ATP's ability to treat the contaminated soil were observed.

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